MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EEE7226 – QUALITY SYSTEMS AND MANAGEMENT

(MEEE)

7th OCTOBER 2016
2:30 pm - 5:30 pm
(3 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **12** pages, including cover page, with **2** sections. Attempt **ALL** questions.
2. **Section A** consists of Multiple Choice Questions. Write your answers on the Multiple Choice answer sheet given and attach it together with your answer Booklet of **Section B**.
3. **Section B** consists of descriptive and statistical questions. Provide your solutions on the answer Booklet given. Any graphs drawn on graph papers must be attached together with the answer Booklet.

SECTION A: Multiple Choice Questions, answer All (20 Marks)

1. The overall intentions and direction of an organization with regard to quality as formally expressed by top management is a:
   (a) Quality Plan
   (b) Quality Statement
   (c) Quality Policy
   (d) TQM
   (e) Quality Objective

2. The definition of quality that involves the product functioning as expected without failure is:
   (a) Performance.
   (b) Conformance.
   (c) Reliability.
   (d) Standardization.
   (e) Endurance.

3. The following quality gurus are matched with their best known contributions to quality, except
   (a) Walter Shewhart – PDCA cycle
   (b) Kaoru Ishikawa – Cause and Effect diagram
   (c) Deming – 14-Points for management
   (d) Philips Colby – quality is free
   (e) Joseph Juran – Juran Methodology.

4. In statistical process control, what measures the central tendency of a set of data?
   (a) Coefficient of variation
   (b) Variance
   (c) Standard deviation
   (d) Mean
   (e) Range

5. In Control Charts, upper and lower control limits are usually set at ± how many standard deviations from the mean?
   (a) 0.5
   (b) 1.0
   (c) 2.0
   (d) 3.0
   (e) 6.0

6. In six-sigma, the level of defects is reduced to approximately
   (a) 2.4 parts per million.
   (b) 1.4 parts per million.
   (c) 24.4 parts per million.
   (d) 3.4 parts per million.
   (e) 34.4 parts per million.

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7. Cost of quality includes:
   (a) Cost of all work to build a product or service that conforms to the requirements
   (b) Training programs
   (c) Cost of all work resulting from non-conformance to the requirements
   (d) (a) and (b)
   (e) All of the above

8. A company incurred the following quality costs at the beginning of the year.
   Evaluating finished product RM65,000
   Quality auditor training RM 25,000
   Manufacturability study RM 15,000
   Repairing finished product RM 15,000
   Process capability studies RM 30,000

   How much did the company spend on prevention costs?
   (a) RM 15,000
   (b) RM 70,000
   (c) RM 60,000
   (d) RM 150,000
   (e) RM 75,000

9. For the standard normal distribution, how much confidence is provided within 2 standard deviations above and below the mean?
   (a) 97.22%
   (b) 95.44%
   (c) 99.74%
   (d) 99.87%
   (e) 90.00%

10. For the standard normal distribution, how much confidence is provided within 3 standard deviations above and below the mean?
   (a) 97.22%
   (b) 95.44%
   (c) 99.74%
   (d) 99.87%
   (e) 90.00%.

11. In SPC, p-chart is used to monitor the manufacturing process when
   (a) only the number of defective items is known, but not the total samples.
   (b) the number of defective items and the total number of samples are known.
   (c) changes in the mean of measured samples are to be monitored.
   (d) the standard deviation or variability of measured samples is to be monitored for improvement purposes.
   (e) control charts for variables are not available.

Continued....

12. A six sigma team has been formed to improve an existing process. Which of the following tools should the team use first to gain a clear understanding of the current process?
    (a) Flowchart.
    (b) Pareto chart.
    (c) Process FMEA.
    (d) Taguchi Loss Function.
    (e) Check sheet.

13. When analysing quality a project, a tool provides a creative way to look at the causes or potential causes of a problem. What is this tool called?
    (a) Cause and effect diagram
    (b) Scatter diagram
    (c) Ishikawa diagram
    (d) Pareto diagram
    (e) (a) and (c)

14. The quality improvement approach defined by best practices is
    (a) quality function deployment
    (b) benchmarking
    (c) quality by design
    (d) ISO 14000
    (e) GMP

15. In statistical quality control, variation in the production process leads to:
    (a) quality defects.
    (b) process improvement opportunities.
    (c) quality improvements.
    (d) product consistency.
    (e) service improvements.

16. What are the four most common control charts?
    (a) x-bar, R, p, c
    (b) x-bar, R, p, OC
    (c) x-bar, R, c, OC
    (d) x-bar, p, c, OC
    (e) R, p, c, OC

17. The process of evaluating overall performance of project or production process, on a regular basis to provide confidence that the project/production line will satisfy the relevant quality standards is called:
    (a) Quality Assurance
    (b) Quality Control
    (c) Quality Planning
    (d) Quality Review
    (e) Quality Audit

Continued....

18. Quality is:
    (a) Zero defects found
    (b) Conformance to requirements
    (c) The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs
    (d) (b) and (c)
    (e) All the above

19. The process of monitoring specific results of production process or project to determine if they comply with relevant quality standards is called:
    (a) Quality Assurance
    (b) Quality Control
    (c) Quality Planning
    (d) Quality Review:
    (e) Quality Audit

20. Which of the following statements about the cost of quality are true?
    (a) The cost of quality is the expense of non-conformance to requirements and specifications
    (b) The costs of quality are mostly the direct responsibility of workers who are manufacturing the product
    (c) Quality control programs should only be implemented when the cost of quality is low
    (d) (a) and (b)
    (e) (a) and (c)

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SECTION B

Question 1

(a) Define the terms Total Quality Management (TQM), Just-in-Time (JIT) and Process Re-Engineering. Briefly indicate what they have in common. [8 marks]

(b) A TQM initiative in an organisation requires the application of *tools* and the participation of the people of the organisation. Give four examples of these tools and describe how they are used in TQM implementation. [4 marks]

(c) The basic philosophy of TQM is the recognition that a work activity is a *process*. With the help of a suitable diagram, describe how a supplier of an organisation is linked to the organisation's eventual customers [8 marks]

Question 2

(a) The ISO 9000:2015 is the latest revision of the ISO 9001 standard. It is a set of quality management system standards that is founded on a set of Quality Management Principles (QMP).

(i) Identify 3 (Three) of these management principles and for each of these principles provide a brief description of its purpose. [6 marks]

(ii) For each of the management principles mentioned in Question 4 (b)(i) above, indicate some examples of its key benefits and what this principle typically leads to. [6 marks]

(iii) Identify and briefly describe the QMP of ISO 9001's earlier revisions, which has now been omitted in Revision 2015. [3 marks]

(b) As part of the on-going TQM initiative, Fizz Soft-Drink Industry plans to improve the reliability of its manufacturing process. Its bottling operation consists of 3 (Three) subsystems as shown in Figure Q2(b)(i). After a scheduled preventive maintenance activity was carried out on Subsystems A and B, the maintenance team has found that the probability of each of these subsystems to operate is 99.99%.

(i) Calculate the reliability of Subsystem B if the overall reliability of the production system, R_S was estimated to be 0.92. [2 marks]

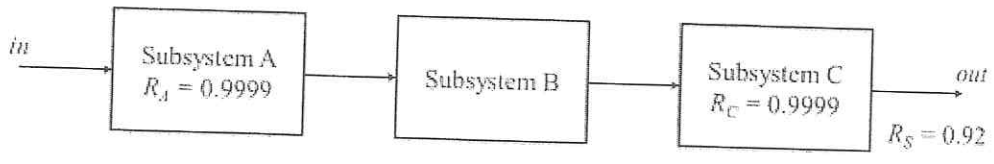

Figure Q2(b)(i): Fizz Soft-Drink Production Subsystems

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(ii) To improve the reliability of Subsystem B, a similar subsystem with a reliability figure of 0.97 is connected in parallel as shown in Figure Q2(b)(ii). Calculate the new reliability of the entire system. [3 marks]

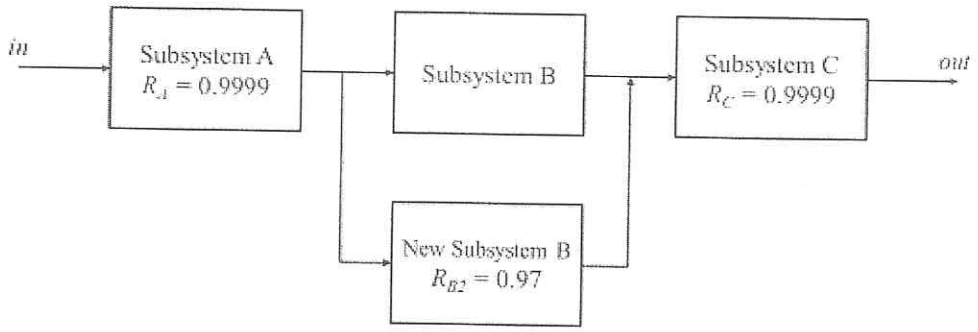

Figure Q2(b)(ii): Improvement of Fizz Soft-Drink Subsystems

Question 3

Joseph Juran's contributions in the field of quality management and process improvement, as embodied in his *Quality Control Handbook*, are a classic guide in the implementation of continuous improvement initiatives. As a manual, the *Handbook* outlines Juran's management ideas and methodology.

(a) Name this methodology and describe its main components. [4 marks]

(b) Draw a representation of this methodology, and show the difference sequence and performance over time. [4 marks]

(c) For each of these components, describe its objectives and the activities involved in realising these objectives. [9 marks]

(d) Describe how these components embody the concept of continuous improvement. [3 marks]

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Question 4

A quality control inspector at FizKola Softdrink Co. has taken 15 (Fifteen) samples with 4 (Four) observations each of the volume of bottles filled. The data and the computed means are shown in Table Q4 below. If the standard deviation of the bottling operation of 500 millilitre soft drink is 4.32 millilitre, use this information to perform the followings:

(i) complete Table Q4 by calculating the remaining mean volume of the soft drink content ($\bar{X}$) and the range, R, of each sample. [2 marks]

(ii) find the average of the sample means ($\bar{\bar{X}}$) and the mean range ($\bar{R}$) of the samples. [4 marks]

(iii) develop the control limits of 3 standard deviations for the x-bar chart of the manufacturing operation. [4 marks]

(iv) plot the x-bar chart showing both the upper and lower control limits. [3 marks]

(v) determine the Upper Control Limit (UCL) and Lower Control Limit (LCL) of the R-bar chart and plot the graph. [7 marks]

Sample Number	Content of Soft Drink in millilitre				Average $\bar{x}$	Range R
	Obsv 1	Obsv 2	Obsv 3	Obsv 4		
1	496.90	502.23	506.30	499.41	501.21	9.40
2	505.36	501.60	496.90	501.91	501.44	8.46
3	501.60	498.78	499.72	496.27	499.09	5.33
4	507.87	496.90	493.45	499.41	499.41	14.42
5	493.45	497.21	508.18	504.74	500.89	14.73
6	499.72	501.91	505.99	502.54	502.54	6.27
7	493.76	508.18	501.91	497.21	500.27	14.42
8	495.96	499.72	502.23	499.72	499.41	6.27
9	502.85	500.97	495.33	500.97	500.03	7.52
10	490.31	499.41	503.17	503.17		
11	505.05	504.74	501.91	495.96		
12	492.82	496.90	505.36	506.30		
13	496.90	501.60	493.45	500.97		
14	493.14	496.58	500.35	504.74		
15	507.87	501.91	504.74	498.15		

Table Q4

End of Page

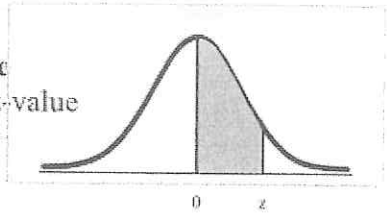
Relevant Equations

1	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$	$\sigma_{(x)} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}$	$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$
2	$\mathrm{UCL}_{(\bar{x})} = \bar{\bar{x}} + z\sigma_{\bar{x}}$	$\mathrm{LCL}_{(\bar{x})} = \bar{\bar{x}} - z\sigma_{\bar{x}}$	$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
3	$\mathrm{UCL}_{(R)} = \bar{\bar{x}} + A_2\bar{R}$	$\mathrm{LCL}_{(R)} = \bar{\bar{x}} - A_2\bar{R}$	-
4	$\mathrm{UCL}_{(R)} = D_4\bar{R}$	$\mathrm{LCL}_{(R)} = D_3\bar{R}$	-
5	$\mathrm{UCL}_{(P)} = \bar{p} + z(\sigma_p)$	$\mathrm{LCL}_{(P)} = \bar{p} - z(\sigma_p)$	$\sigma_p = \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$
6	$\mathrm{UCL}_{(c)} = \bar{c} + z\sigma_c$	$\mathrm{LCL}_{(c)} = \bar{c} - z\sigma_c$	$\sigma_c = \sqrt{\bar{c}}$
7	System Reliability	$R_{SP}(t) = 1 - \prod_{i=1}^{n}[1 - R_i(t)]$	$R_{SS}(t) = R_1 \times R_2 \times R_3 \times .....R_n$

Table of Factors for 3-Sigma Control Limits of *x*-chart and *R*-chart

Observations in Sample (n)	A	A_2	D_1	D_2	D_3	D_4	A_3	B_3	B_4	d_2	c_4
2	2.121	1.88	0	3.686	0	3.267	2.659	0	3.267	1.128	0.7979
3	1.732	1.023	0	4.358	0	2.574	1.954	0	2.568	1.693	0.8862
4	1.5	0.729	0	4.698	0	2.282	1.628	0	2.266	2.059	0.9213
5	1.342	0.577	0	4.918	0	2.114	1.427	0	2.089	2.326	0.94
6	1.225	0.483	0	5.078	0	2.004	1.287	0.03	1.97	2.534	0.9515
7	1.134	0.419	0.204	5.204	0.076	1.924	1.182	0.118	1.882	2.704	0.9594
8	1.061	0.373	0.388	5.306	0.136	1.864	1.099	0.185	1.815	2.847	0.965
9	1	0.337	0.547	5.393	0.184	1.816	1.032	0.239	1.761	2.97	0.9693
10	0.949	0.308	0.687	5.469	0.223	1.777	0.975	0.284	1.716	3.078	0.9727
11	0.905	0.285	0.811	5.535	0.256	1.744	0.927	0.321	1.679	3.173	0.9754
12	0.866	0.266	0.922	5.594	0.283	1.717	0.886	0.354	1.646	3.258	0.9776
13	0.832	0.249	1.025	5.647	0.307	1.693	0.85	0.382	1.618	3.336	0.9794
14	0.802	0.235	1.118	5.696	0.328	1.672	0.817	0.406	1.594	3.407	0.981
15	0.775	0.223	1.203	5.741	0.347	1.653	0.789	0.428	1.572	3.472	0.9823

TABLE A: The STANDARD NORMAL DISTIBUTION Table
"Cell" entries are areas under the N(0,1) curve between 0 and the z-value



NOTE: In calculating a z-value before entering these tables, always round correctly to two places of decimal.

0.0000	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700	0.0800	0.0900	
0.0000	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1000	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2000	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3000	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4000	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5000	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6000	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7000	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8000	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9000	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0000	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1000	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2000	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3000	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4000	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5000	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6000	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7000	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8000	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9000	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0000	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1000	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2000	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3000	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4000	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5000	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6000	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7000	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8000	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9000	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0000	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Template for Question 4

(To be stapled together and submitted with the answer script if used)

Sample Number	Content of Soft Drink in millilitre				Average $\bar{x}$	Range R
	Obsv 1	Obsv 2	Obsv 3	Obsv 4		
1	496.90	502.23	506.30	499.41	501.21	9.40
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5	493.45	497.21	508.18	504.74	500.89	14.73
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7	493.76	508.18	501.91	497.21	500.27	14.42
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13	496.90	501.60	493.45	500.97		
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Graph Paper for Question 4

(To be stapled together and submitted with the answer script if used)